Pre-AP Geometry Date_____ 3.2 Notes
Proof and Perpendicular Lines (pp 136–138)

CONCEPT SUMMARY

TYPES OF PROOFS

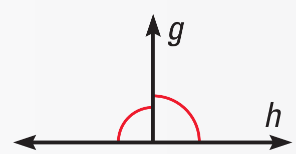
You have now studied three types of proofs.

1. **TWO-COLUMN PROOF** This is the most formal type of proof. It lists numbered statements in the left column and a reason for each statement in the right column.
2. **PARAGRAPH PROOF** This type of proof describes the logical argument with sentences. It is more conversational than a two-column proof.
3. **FLOW PROOF** This type of proof uses the same statements and reasons as a two-column proof, but the logical flow connecting the statements is indicated by arrows.

THEOREMS

THEOREM 3.1

If two lines intersect to form a linear pair of congruent angles, then the lines are perpendicular.



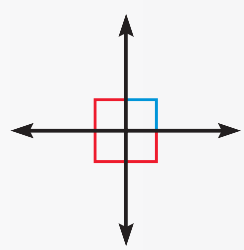
$g \perp h$

THEOREM 3.2

If two sides of two adjacent acute angles are perpendicular, then the angles are complementary.

THEOREM 3.3

If two lines are perpendicular, then they intersect to form four right angles.



A. Open the geometer's sketchpad program.

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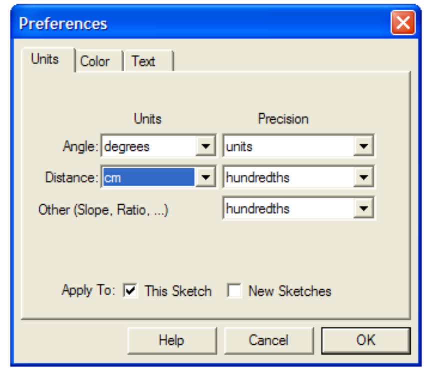
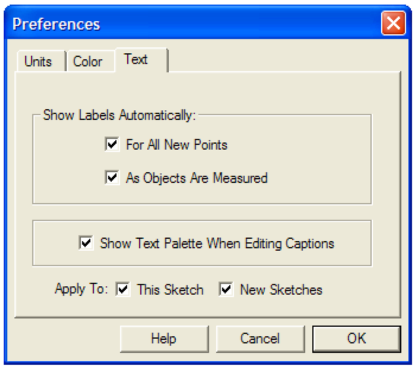
B. In the edit menu, go the preferences and change "Angle" degrees with a precision of units. distance to cm with a precision of hundredths and "other" to a precision of hundredths. Change your text to the following.





C. Draw line $\overleftrightarrow{AB}$.

D. Draw line $\overleftrightarrow{CD}$ such that C is on $\overleftrightarrow{AB}$ and C is between A & B.

E. Measure $\measuredangle ACD$ & $\measuredangle BCD$.

F. Adjust $\overleftrightarrow{CD}$ so that $\measuredangle ACD \cong \measuredangle BCD$.

G. What types of angles have you formed?

H. What is true about $\overleftrightarrow{AB}$ & $\overleftrightarrow{CD}$? How do you know?

I. Conjecture about two lines that form a linear pair of congruent angles.

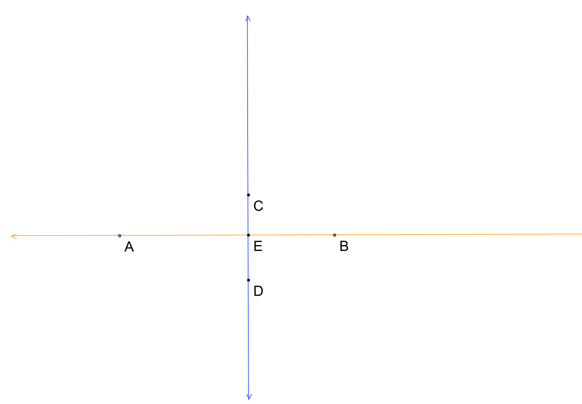
J. Under the file menu, choose document options. Add a new page.

K. Draw line $\overleftrightarrow{AB}$ and point C not on $\overleftrightarrow{AB}$.

L. Construct a line perpendicular to $\overleftrightarrow{AB}$.

M. Label the point of intersection with a point and make sure you have a point above, below, left and right of the intersection.

N. Measure the four angles formed.



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O. Conjecture about the angles formed when you have 2 perpendicular lines.

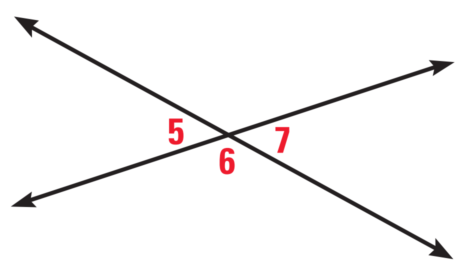
1. Example: Do the following as flow proof.

There is more than one way to write a proof. The two-column proof below is from Lesson 2.6. It can also be written as a paragraph proof or as a *flow* proof. A **flow proof** uses arrows to show the flow of the logical argument. Each reason in a flow proof is written below the statement it justifies.

EXAMPLE 1 *Comparing Types of Proof*

GIVEN ▶ $\angle 5$ and $\angle 6$ are a linear pair.
$\angle 6$ and $\angle 7$ are a linear pair.

PROVE ▶ $\angle 5 \cong \angle 7$



Method 1 Two-column Proof

Statements	Reasons
1. $\angle 5$ and $\angle 6$ are a linear pair. $\angle 6$ and $\angle 7$ are a linear pair.	**1.** Given
2. $\angle 5$ and $\angle 6$ are supplementary. $\angle 6$ and $\angle 7$ are supplementary.	**2.** Linear Pair Postulate
3. $\angle 5 \cong \angle 7$	**3.** Congruent Supplements Theorem

Method 2 Paragraph Proof

Because $\angle 5$ and $\angle 6$ are a linear pair, the Linear Pair Postulate says that $\angle 5$ and $\angle 6$ are supplementary. The same reasoning shows that $\angle 6$ and $\angle 7$ are supplementary. Because $\angle 5$ and $\angle 7$ are both supplementary to $\angle 6$, the Congruent Supplements Theorem says that $\angle 5 \cong \angle 7$.

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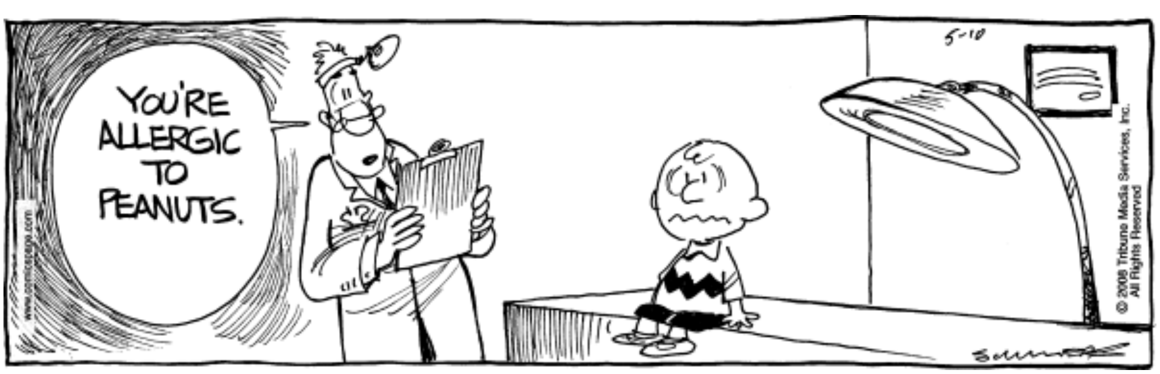
Method 3 *Flow Proof*

$\angle 5$ and $\angle 6$ are a linear pair. Given	→	**$\angle 5$ and $\angle 6$ are supplementary.** Linear Pair Postulate	↘	**$\angle 5 \cong \angle 7$** Congruent Supplements Theorem
$\angle 6$ and $\angle 7$ are a linear pair. Given	→	**$\angle 6$ and $\angle 7$ are supplementary.** Linear Pair Postulate	↗	

1. **Given:** AB = CD
Prove: AC = BD



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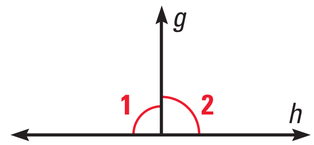
Proof

EXAMPLE 2 ***Proof of Theorem 3.1***

Write a proof of Theorem 3.1.



SOLUTION

GIVEN ▶ $\angle 1 \cong \angle 2$, $\angle 1$ and $\angle 2$ are a linear pair.

PROVE ▶ $g \perp h$

Plan for Proof Use $m\angle 1 + m\angle 2 = 180°$ and $m\angle 1 = m\angle 2$ to show $m\angle 1 = 90°$.

$\angle 1$ and $\angle 2$ are a linear pair.
Given
↓
$\angle 1$ and $\angle 2$ are supplementary.
Linear Pair Postulate
↓
$m\angle 1 + m\angle 2 = 180°$
Def. of supplementary $\measuredangle$s

$\angle 1 \cong \angle 2$
Given
↓
$m\angle 1 = m\angle 2$
Def. of $\cong$ angles

→ **$m\angle 1 + m\angle 1 = 180°$**
Substitution prop. of equality
→ **$2 \cdot (m\angle 1) = 180°$**
Distributive prop.
→ **$m\angle 1 = 90°$**
Div. prop. of equality
→ **$\angle 1$ is a right $\angle$.**
Def. of right angle
→ **$g \perp h$**
Def. of $\perp$ lines

STUDENT HELP

Study Tip
When you write a complicated proof, it may help to write a plan first. The plan will also help others to understand your proof.

"WE DID THE WHOLE ROOM OVER IN FRACTALS."

Sydney Harris, Fractal Cartoon

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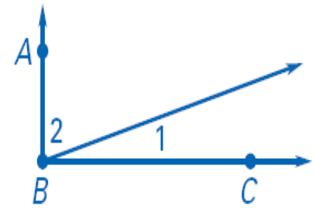
2. Example: If two sides of two adjacent acute angles are perpendicular, then the angles are complementary.



Given: $\overline{BA} \perp \overline{BC}$

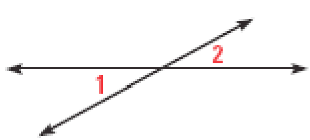
Prove: $\measuredangle 1$ & $\measuredangle 2$ are complementary

3. Define perpendicular lines.

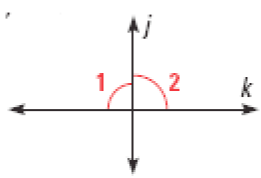
4. Which postulate or theorem guarantees that there is only one line that can be constructed perpendicular to a given line from a given point not on the line?

Write the postulate or theorem that justifies the statement about the diagram.

5. $\measuredangle 1 \cong \measuredangle 2$

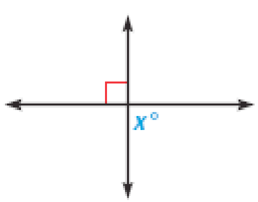


6. $j \perp k$

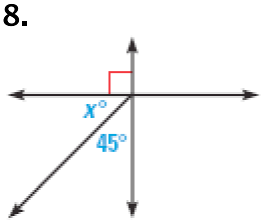


Find the value of x.

7.



8.



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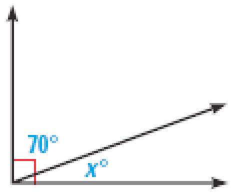
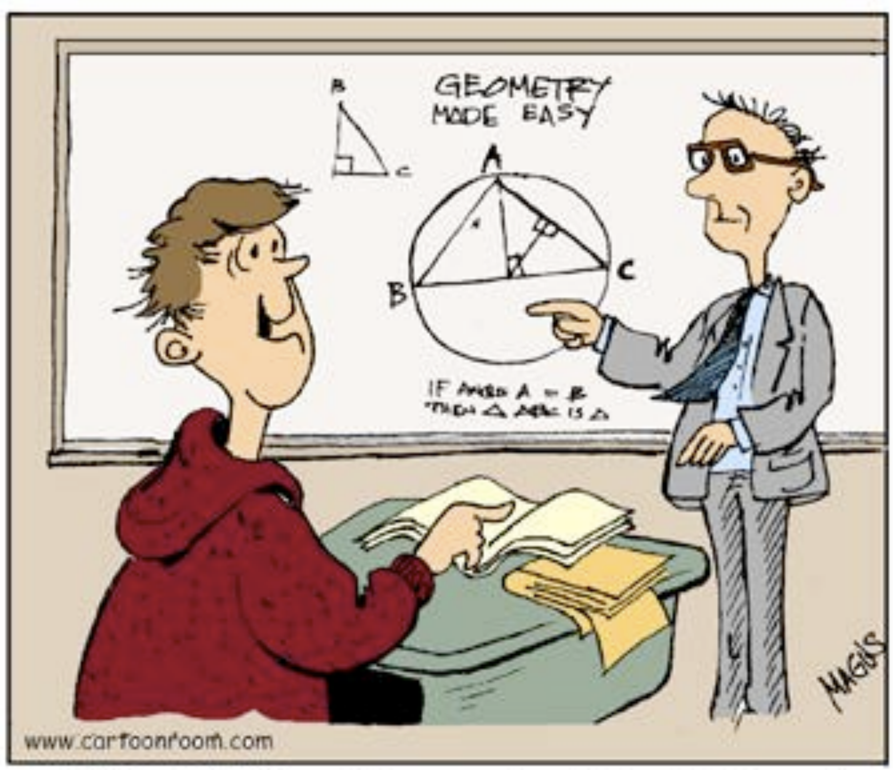
9. Find the value of x.



10. It is given that $\measuredangle ABC \cong \measuredangle CBD$. A student concludes that because $\measuredangle ABC$ & $\measuredangle CBD$ are congruent angles adjacent angles, $\overleftrightarrow{AB} \perp \overleftrightarrow{CB}$. What is wrong with this reasoning? Draw a diagram to support your answer.



My brain is like a full computer disk... I'll have to forget something before I can learn your stuff.